Ninety-Seventh

Meeting

of

The Electrochemical Society, Inc.

CLEVELAND

April 19, 20, 21 and 22, 1950

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Ninety-Seventh Meeting

Wednesday through Saturday
April 19, 20, 21, and 22

CONDENSED TECHNICAL PROGRAM

Rare Metals

Wednesday morning, April 19—10:15 A.M.-12:45 P.M.
(Pine Room)

Wednesday afternoon, April 19—2:00 P.M.-5:30 P.M.
(Pine Room)

Thursday morning, April 20—See note on page 10.

Thursday afternoon, April 20—2:00 P.M.-5:30 P.M.
(Ohio Room)

Electronics-Instrumentation

Wednesday morning, April 19—10:15 A.M.-12:45 P.M.
(Ohio Room)

Wednesday afternoon, April 19—2:00 P.M.-3:30 P.M.
(Ohio Room)

Industrial Electrolytic-Instrumentation

Wednesday afternoon, April 19—3:30 P.M.-4:30 P.M.
(Ohio Room)

Thursday morning, April 20—9:00 A.M.-12:00 M.
(Ohio Room)

Electrothermic

Wednesday morning, April 19—See note on page 6.

Wednesday afternoon, April 19—2:00 P.M.-4:30 P.M.
(Room 345)

Thursday morning, April 20—9:00 A.M.-12:00 M.
(Room 345)

Thursday afternoon, April 20—2:00 P.M.-4:30 P.M.
(Room 345)

Friday morning, April 21—9:00 A.M.-12:00 M.
(Pine Room)

Friday afternoon, April 21—2:00 P.M.-5:00 P.M.
(Pine Room)

Saturday morning, April 22—9:00 A.M.-12:00 M.
(Pine Room)

Luminescence

Thursday morning, April 20—9:00 A.M.-12:15 P.M.
(Pine Room)

Luminescence (cont'd)

Thursday afternoon, April 20—2:00 P.M.-5:30 P.M.
(Pine Room)

Theoretical Electrochemistry

Friday morning, April 21—9:00 A.M.-12:20 P.M.
(Ohio Room)

Friday afternoon, April 21—2:00 P.M.-3:15 P.M.
(Ohio Room)

Electric Insulation

Friday afternoon, April 21—3:15 P.M.-5:15 P.M.
(Ohio Room)

Saturday morning, April 22—9:00 A.M.-12:00 M.
(Ohio Room)

GENERAL INFORMATION

Convention Headquarters will be at the **Statler Hotel,** Euclid Avenue at East Twelfth Street, Cleveland 1, Ohio. The registration desk will be in Ballroom Mezzanine.

Rates for rooms will be: single room $4.00 to $7.00; double rooms with double bed, $7.00 to $10.00; twin bedroom, $8.00 to $12.00; suites of living room, bedroom, and bath, $16.00 to $22.50.

Requests for room reservations should be made to Front Office Manager, Hotel Statler, Euclid Avenue at East Twelfth Street, Cleveland 1, Ohio.

REGISTRATION

Registration of members and guests will begin at 8:30 A.M. Wednesday, April 19th, and will continue to 9:00 P.M. On Thursday the registration will be open from 8:00 A.M. to 5:00 P.M., on Friday from 8:30 A.M. until 5:00 P.M., and on Saturday from 8:30 A.M. until 12:00 noon.

The registration fees through Wednesday, Thursday, or Friday are:

Members	$5.00	Ladies	$2.00
Nonmembers not included above	$7.00	Students	$1.00
Saturday morning only	$1.00		

Advance registration tickets costing $5.00 may be obtained by members and nonmembers from Mr. L. E. Pucher, The Willard Storage Battery Company, 246 East 131st Street, Cleveland 1, Ohio.

ANNUAL BUSINESS MEETING

The Annual Business Meeting of the Society will be held Thursday, April 20th, immediately following the noonday luncheon.

LUNCHEONS AND DINNERS

Thursday Luncheon

This will be held at 12:30 P.M. in the Euclid Ballroom. There is no feature speaker planned for this luncheon. However, this time will be devoted to the Annual Business Meeting of the Society.

Thursday Evening Reception and Banquet

A reception for President and Mrs. Ferguson will be held at 6:00 P.M. in the Pine Room, following which the Annual Banquet of the Society will be served at 7:30 P.M. in the Euclid Ballroom, with Mr. W. G. Harvey as toastmaster. Following the dinner, the Young Author's Prize and the Turner Book Prize will be awarded. The featured event will be the Presidential Address, to be delivered by President Ferguson.

Friday Luncheons

There is no general Society luncheon planned at this time. However, the following divisions are planning divisional luncheons: Industrial Electrolytic, Electric Insulation, Electrothermic, and Electronics.

Friday Dinner, Entertainment, and Dancing

A cocktail hour has been planned for 6:00 P.M., after which dinner will be served in the Statler Ballroom at 7:15 P.M. Immediately following the dinner, there will be informal entertainment provided by the Local Committee. Following the program, a well-known orchestra will provide music for dancing.

LADIES' PROGRAM

A full program is planned for the ladies, consisting of:

Thursday Morning: The ladies will tour the west side of Cleveland and its suburbs and will have their luncheon in the beautiful Seaglade room of the Lake Shore Hotel, overlooking Lake Erie, after which Miss Elizabeth Kardos, Director of the Kardos Fashion Institute of Cleveland, will provide a program devoted to the subject of "Packaging Your Personality."

Friday Morning: Tour of the east side of Cleveland and its suburbs, followed by a complimentary luncheon at one of the local country clubs.

PLANT TRIPS

The program includes two trips of special interest to electrochemists. These trips are scheduled for Thursday and Friday afternoons.

Thursday Afternoon: The Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics. This trip is limited

to members of the Society who are U. S. citizens and registrants at the Convention.

Friday Afternoon: The B. F. Goodrich Research Center. This trip is limited to registrants at the Convention.

Cost of the round-trip bus fare will be $1.50 for each trip.

ANNUAL BUSINESS MEETINGS OF DIVISIONS

Electronics Division—will hold its annual business meeting and election of officers at the Divisional Luncheon on Friday, April 21st, at 12:30 P.M. in Parlor C.

Electrothermic Division — annual business meeting and election of officers for the coming year will be held during the Division's luncheon, which is scheduled for Friday, April 21st, at 12:30 P.M. in Parlor L.

Electric Insulation Division—has scheduled its annual business meeting and election of officers for Friday, April 21st, at the Divisional Luncheon, to be held at 12:30 P.M. in Parlor G.

Industrial Electrolytic Division—annual business meeting and election of officers has been scheduled for the Divisional Luncheon, to be held Friday, April 21st, at 12:30 P.M. in Parlor E.

Theoretical Electrochemistry Division — will hold its annual business meeting and election of officers at 12:20 P.M. on Friday, April 21st, following its technical program.

Rare Metals Group—will hold a dinner business meeting on Wednesday, April 19th. Time and place to be announced.

REPRINTS

Copies of the January, February, March, and April issues of the JOURNAL OF THE ELECTROCHEMICAL SOCIETY containing papers presented will be available at the Registration desk. The price of single copies of the JOURNAL is $.75 to members and $1.00 to nonmembers.

DISCUSSION

There will be no recordings made of oral discussions. Those contributing to the discussion of a paper and desiring their remarks published will be supplied with a printed form on which any discussion may be written. These forms must be given to the Secretary-Treasurer of the Division at the end of the session. The discusion will then be referred to the authors for reply. Written discussion will be accepted up to two months following publication of any article in the JOURNAL.

A discussion section will be published semiannually in the JOURNAL.

COST OF VARIOUS FUNCTIONS

(other than registration)

Thursday Luncheon (Men)	$2.50
Thursday Luncheon and Trip (Ladies)	2.00
Thursday Plant Trip	1.50
Thursday Banquet and Reception	5.50
Friday Luncheons (Men)	2.50
Friday Luncheon (Ladies)	Complimentary
Friday Dinner, Dance, and Entertainment	4.75

(Gratuities are included in the above costs)

BOARD AND COMMITTEE MEETINGS

Wednesday, April 19, 1950

10:00 A.M.—Meeting of Local Section Advisory Committee, Parlor F.

10:00 A.M.—Meeting of Review Committee and Editorial Staff, Parlor L.

2:00 P.M.—Meeting of Ways and Means Committee, Parlor L.

7:30 P.M.—Meeting of the Board of Directors, Tavern Room.

MEETING ROOM SCHEDULE

Meetings	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Friday A.M.	Friday P.M.	Saturday A.M.
Rare Metals	A	A		B			
Electronics-Instrumentation	B	B*					
Industrial Electrolytic-Instrumentation		B*	B				
Electrothermics		C	C	C	A	A	A
Luminiscence			A	A			
Theoretical Electrochemistry					B	B**	
Electric Insulation						B**	B

A—Meeting will be held in Pine Room.

B—Meeting will be held in Ohio Room.

C—Meeting will be held in Room 345.

* The Electronics and Industrial Electrolytic Divisions will sponsor a joint session on Instrumentation on Wednesday afternoon.

** The Theoretical Electrochemistry and Electric Insulation Divisions will hold a joint session on Friday afternoon.

Technical Program

WEDNESDAY, APRIL 19, 1950

10:00 A.M.—Formal opening of the 97th Convention with Introduction by General Chairman Leon R. Westbrook and Response by President Ferguson.

WEDNESDAY A.M.

Symposium on Rare Metals
Titanium, Zirconium, and Palladium
with Dr. Bruce W. Gonser presiding
(PINE ROOM)

Note: The Electrothermic Division has scheduled no session on the new highly-refractory materials at this time, to permit members and guests to attend the Rare Metals Symposium.

10:15 A.M.—Opening of the session, with welcome by Chairman Gonser.

10:20 A.M.—Keynote Address, "The Less Important Metals and the Future," by B. S. Hopkins.

10:40 A.M.—"Beneficiation of High Titanium Indian Bauxite through Chlorination" by Colin G. Fink and K. G. Hrishikesan, Columbia University, New York, N. Y. (Abstract No. 1)

11:05 A.M.—"The Formation of Refractory Coatings by Vapor-Deposition Methods. II. The Deposition of Group IV Metals" by C. F. Powell, I. E. Campbell, Battelle Memorial Institute, Columbus, Ohio, and C. C. Heim, Kaiser Aluminum and Chemical Corporation, Spokane, Wash. (Abstract No. 2)

11:30 A.M.—"Heat Resistance of Zirconium in Several Media" by E. T. Hayes, A. H. Roberson, and R. H. Robertson, U. S. Bureau of Mines, Albany, Ore. (Abstract No. 3)

11:55 A.M.—"Improvements in the Methods for the Reduction of Zirconium Chloride with Magnesium" by W. J. Kroll, W. F. Hergert, and L. A. Yerkes, U. S. Bureau of Mines, Albany, Ore. (Abstract No. 4)

12:20 P.M.—"Palladium Plating Baths for Heavy Deposits and Electroforming" by E. M. Wise and R. F. Vines, International Nickel Company, New York, N. Y. (Abstract No. 5)

(This symposium will continue at 2:00 P.M., Wednesday, April 19th, in the Pine Room.)

Symposium on Instrumentation
with Professor E. A. Arnold presiding
(OHIO ROOM)

10:15 A.M.—"Selection of Talc for Industrial Uses by X-Ray Diffraction" by G. L. McCreery, The Ohio Brass Company, Barberton, Ohio (Abstract No. 20)

10:45 A.M.—"High Temperature and Controlled Atmosphere X-Ray Diffraction Techniques" by

J. J. Lander, Bell Telephone Laboratories, Murray Hill, N. J. (Abstract No. 21)

11:15 A.M.—"The Applicability of Ultrasonics to Continuous Gas Analysis" by J. C. Hubbard, The Catholic University of America, Washington, D. C. (Abstract No. 22)

11:45 A.M.—"Selective Infrared Gas Analysis" by Wm. G. Fastie, Leeds & Northrup Company, Philadelphia, Pa. (Abstract No. 23)

12:15 P.M.—"Ultraviolet Methods of Continuous Gas Analysis" by L. G. Glasser, Engineering Research Laboratory, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del. (Abstract No. 24)

(This symposium will continue at 2:00 P.M., Wednesday, April 19th, in the Ohio Room.)

Symposium on Rare Metals (cont'd)
Gallium, Germanium, Selenium, and Thallium
with Dr. John R. Musgrave presiding

(PINE ROOM)

2:00 P.M.—"The Electrochemistry of Gallium" by William M. Saltman and Norman H. Nachtrieb, Institute for the Study of Metals, The University of Chicago, Chicago, Ill. (Abstract No. 6)

2:30 P.M.—"Evaluation of Quality of Germanium by Electrical Methods" by W. C. Dunlap, Jr., Research Laboratory, General Electric Company, Schenectady, N. Y. (Abstract No. 7)

3:00 P.M.—"Single Crystals of Germanium and Investigation of Single Grain Boundaries" by W. E. Taylor, H. Y. Fan, and K. Lark-Horovitz, Department of Physics, Purdue University, Lafayette, Ind. (Abstract No. 8)

3:30 P.M. — "Counterelectrodes for Selenium Rectifiers" by Wm. B. Roberts, Sylvania Electric Products Inc., Bayside, L. I., N. Y. (Abstract No. 9)

4:00 P.M.—"The Formation of Refractory Coatings by Vapor-Deposition Methods. iV. The Deposition of Chromium, Molybdenum, Tungsten, Uranium, Rhenium, and the Platinum Group Metals. The Deposition and Formation of Alloy Coatings" by D. L. Day, C. F. Powell, I. E. Campbell, Battelle Memorial Institute, Columbus, Ohio, and C. C. Heim, Kaiser Aluminum and Chemical Corporation, Spokane, Wash. (Abstract No. 10)

WEDNESDAY P. M.

4:30 P.M.—"Ductile Chromium" by W. J. Kroll, W. F. Hergert, and L. A. Yerkes, U. S. Bureau of Mines, Albany, Ore. (Abstract No. 11)

5:00 P.M.—"The Properties and Uses of Thallium" by H. E. Howe and A. A. Smith, Jr., Research Department, American Smelting and Refining Company, Barber, N. J. (Abstract No. 12)

(This symposium will continue at 2:00 P.M., Thursday, April 20th, in the Ohio Room.)

Symposium on Instrumentation (cont'd)
with Professor E. A. Arnold presiding

(OHIO ROOM)

2:00 P.M.—"A Cathode-Ray Recording Apparatus for Polarization Studies" by A. L. Ferguson, University of Michigan, Ann Arbor, Mich., and D. R. Turner, Westinghouse Research Laboratories, East Pittsburgh, Pa. (Abstract No. 25)

2:30 P.M. — "Electronic Instrumentation for Overvoltage Measurements" by Dimitrios Staicopoulos, Ernest Yeager, and Frank Hovorka, Departments of Chemistry and Physics, Western Reserve University, Cleveland, Ohio (Abstract No. 26)

3:00 P.M.—"Application of Electrolytic Conductivity of Gas Analyses" by Moyer D. Thomas and James O. Ivie, Department of Agricultural Research, American Smelting and Refining Company, Salt Lake City, Utah (Abstract No. 27)

Symposium on Instrumentation (cont'd)
In the Chlor-Alkali Industry
with Dr. R. B. MacMullin presiding

(OHIO ROOM)

3:30 P.M.—"Instrumentation in a Modern Chlorine Handling Plant" by J. M. Hildyard, Hooker Electrochemical Company, Niagara Falls, N.Y. (Abstract No. 28)

4:00 P.M.—"Liquid Chlorine Level Measurement" by F. S. McCarthy and G. A. Rice, Chemicals Department, Canadian Industries Limited, Montreal, Canada (Abstract No. 29)

(This symposium will continue at 9:00 A.M., Thursday, April 20th, in the Ohio Room.)

THURSDAY A.M.

Symposium on Electrothermics
Borides, Nitrides, and Phase Studies
with Dr. J. T. Norton presiding

(ROOM 345)

2:00 P.M.—"The Metallic Nature of Metal Borides" by S. J. Sindeband and Paul Schwarzkopf, American Electro Metal Corporation, Yonkers, N. Y. (Abstract No. 36)

2:30 P.M.—"The Borides of Some Transition Elements" by Roland Kiessling, Institute of Chemistry, University of Uppsala, Uppsala, Sweden (Abstract No. 37)

3:00 P.M.—"Phase Relationships in the Binary Systems of Nitrides and Carbides of Zirconium, Columbium, Titanium, and Vanadium" by Pol Duwez and Francis Odell, Department of Mechanical Engineering, California Institute of Technology, Pasadena, Calif. (Abstract No. 38)

3:30 P.M.—"Electrothermal Preparation of Pure Crystalline Boron, Boron Nitride, and Boron Carbide, and Their Characteristics" by Eugene Ryshkewitch, 43 Drake Avenue, Dayton, Ohio (Abstract No. 39)

4:00 P.M.—"The Formation of Refractory Coatings by Vapor-Deposition Methods. VI. The Refractory Nitrides, Borides, Silicides, and Oxides" by C. F. Powell, D. H. Nowicki, and I. E. Campbell, Battelle Memorial Institute, Columbus, Ohio (Abstract No. 40)

(This symposium will continue at 9:00 A.M., Thursday, April 20th, in Room 345.)

THURSDAY, APRIL 20, 1950

Symposium on Instrumentation (cont'd)
In the Chlor-Alkali Industry
with Dr. R. B. MacMullin presiding

(OHIO ROOM)

9:00 A.M.—"A Flow Colorimeter Adapted to Chlorine Analysis" by R. C. Hawes, R. R. Davis, A. O. Beckman, National Technical Laboratories, South Pasadena, Calif., and H. H. Cary, Applied Physics Corporation, Pasadena, Calif. (Abstract No. 30)

9:30 A.M.—"Detection of Hydrogen in Chlorine" by Russell E. Cushing, Instrument Process Control Division, Pennsylvania Salt Manufacturing Company, Philadelphia, Pa. (Abstract No. 31)

THURSDAY A.M.

10:00 A.M.—"The Voltage Balance in the Mercury Cell" by Vittorio de Nora, Impianti Elettrochimici, Milan, Italy (Abstract No. 32)

10:30 A.M. — "Automatic Control Applied to 'Karbate' Falling Film Hydrogen Chloride Absorbers" by W. M. Gaylord, National Carbon Division, Union Carbide and Carbon Corporation, Niagara Falls, N. Y. (Abstract No. 33)

11:00 A.M. — "Salt Slurry Control in Caustic Evaporators" by Albert W. Eckstrom, "Buflovak" Equipment Division, Blaw-Knox Company, Buffalo, N. Y. (Abstract No. 34)

11:30 A.M.—"Control of Bleach Manufacture by Oxidation Potential" by D. J. Pye, Great Western Division, The Dow Chemical Company, Pittsburgh, Calif. (Abstract No. 35)

Symposium on Electrothermics (cont'd)
High-Temperature Operations
with Dr. Julian Glasser presiding

(ROOM 345)

Note: The Rare Metals Division has scheduled no session for this morning, so that members and guests may attend the Electrothermic Symposium.

9:00 A.M.—"Some Aspects of the Use of Solar Energy for Studying Highly Refractory Compounds and Materials" by William M. Conn, Physics Department, Rockhurst College, Kansas City, Mo. (Abstract No. 41)

9:30 A.M.—"Refractories for Four Thousand Degrees Plus" by Gordon R. Finlay, Norton Company Research Laboratories, Chippawa, Ontario, Canada (Abstract No. 42)

10:00 A.M.—"Usefulness of Pure Oxide Refractories in Protecting and Insulating High Temperature Thermocouples" by Gary Steven, Armour Research Foundation, Chicago, Ill.

(No abstract supplied.)

10:30 A.M.—"The Protection of Molybdenum from Oxidation in Air at High Temperatures" by C. F. Powell, E. A. Beidler, I. E. Campbell, B. W. Gonser, Battelle Memorial Institute, Columbus, Ohio, and L. F. Yntema, Fansteel Metallurgical Corporation, North Chicago, Ill. (Abstract No. 43)

11:00 A.M.—"Heat Resistant Protective Coatings" by R. A. Williams, I. H. Lutz, and W. H. Hayne, University of Louisville Institute of

THURSDAY A.M.

Industrial Research, Louisville, Ky.
(Abstract No. 44)

11:30 A.M.—"Refining of Magnesium by Vaporization at Extremely Low Pressure" by R. R. Rogers and G. E. Viens, Division of Mineral Dressing and Process Metallurgy, Department of Mines and Technical Surveys, Ottawa, Canada (Abstract No. 45)

(This symposium will continue at 2:00 P.M., Thursday, April 20th, in Room 345.)

Symposium on Luminescence
with Dr. H. C. Froelich presiding

(PINE ROOM)

9:00 A.M.—Introductory remarks.

9:05 A.M.—Invited Keynote Address, "The Ideal Phosphor," by Professor Roland Ward.

9:35 A.M.—"Effect of Thermal History on Color of Zinc Beryllium Silicate (Mn) Phosphors" by Shannon Jones, Lamp Department, General Electric Company, Cleveland, Ohio
(Abstract No. 63)

9:50 A.M.—"Calcium Antimonates" by Keith H. Butler, Martha J. Bergin, and Virginia M. B. Hannaford, Sylvania Electric Products Inc., Salem, Mass., and Bayside, L. I., N. Y.
(Abstract No. 64)

10:20 A.M.—"Spiraling in Fluorescent Lamps" by R. van Male de Ghorain and André Luyckx, Université de Louvain, Louvain, Belgium
(Abstract No. 65)

10:45 A.M.—Five minute stretch.

10:50 A.M.—"A Study of the Mechanism of Sensitized Luminescence of Solids" by James H. Schulman, Robert J. Ginther, and Clifford C. Klick, Crystal Branch, Naval Research Laboratory, Washington, D. C. (Abstract No. 66)

11:35 A.M.—"The Origin of Multiple Bands in Luminophors Activated by Divalent Manganese" by F. A. Kroeger and P. Zalm, Philips Research Laboratories, Eindhoven, Netherlands (Abstract No. 67)

11:55 A.M.—"The Fluorescence of Magnesium Germanate Activated by Manganese" by F. A. Kroeger and J. van den Boomgaard, Philips Research Laboratories, Eindhoven, Netherlands (Abstract No. 68)

(This symposium will continue at 2:00 P.M., Thursday, April 20th, in the Pine Room.)

THURSDAY P. M.

Symposium on Rare Metals (cont'd)
Vanadium and Beryllium
with Dr. Donald M. Wroughton presiding

(OHIO ROOM)

2:00 P.M.—"A Review of the System Vanadium-Oxygen" by N. P. Allen, National Physical Laboratory, Teddington, Middlesex, England (Abstract No. 13)

2:30 P.M.—"The Formation of Refractory Coatings by Vapor-Deposition Methods. III. The Deposition of Vanadium, Tantalum, and Columbium" by L. C. Beale, Jr., C. F. Powell, and I. E. Campbell, Battelle Memorial Institute, Columbus, Ohio (Abstract No. 14)

3:00 P.M.—"Production of Ductile Vanadium by Calcium Reduction of Vanadium Trioxide" by E. D. Gregory, Research Department, Westinghouse Electric Corporation, Bloomfield, N. J. (Abstract No. 15)

3:30 P.M.—"Preparation of Ductile Vanadium by Calcium Reduction" by R. K. McKechnie and A. U. Seybolt, General Electric Company, Schenectady, N. Y. (Abstract No. 16)

4:00 P.M.—"A Preliminary Study of the Reactions of Vanadium with O_2 and N_2" by Earl A. Gulbransen and Kenneth F. Andrew, Westinghouse Research Laboratories, East Pittsburgh, Pa. (Abstract No. 17)

4:30 P.M.—"Equilibria in the Decomposition of Beryllium Iodide at Elevated Temperatures" by Bernard Kopelman and Harry Bender, Sylvania Electric Products, Inc., Bayside, L. I., N. Y. (Abstract No. 18)

5:00 P.M.—"Kinetics of the Reactions of Beryllium with O_2, N_2 and H_2, and the Effects of Oxide and Nitride Films on Its Vapor Pressure" by Earl A. Gulbransen and Kenneth F. Andrew, Westinghouse Research Laboratories, East Pittsburgh, Pa. (Abstract No. 19)

Symposium on Electrothermics (cont'd)
New Highly Refractory Carbides
with Dr. C. H. Chappell presiding

(ROOM 345)

2:00 P.M.—"Effect of Chromium on the Oxidation Resistance of Titanium Carbide" by John D. Roach, Titanium Alloy Manufacturing Division, National Lead Company, Niagara Falls, N. Y. (Abstract No. 46)

2:30 P.M.—"The Formation of Refractory Coatings by the Vapor-Deposition Method. V. The

Refractory Carbides" by C. F. Powell and I. E. Campbell, Battelle Memorial Institute, Columbus, Ohio (Abstract No. 47)

3:00 P.M.—"Preparation of Alumina-Titanium Carbide Bodies by Hot Pressing" by Harold Barr, George D. Cremer, and Walter J. Koshuba, NEPA Division, Fairchild Engine and Airplane Corporation, Oak Ridge, Tenn. (Abstract No. 48)

3:30 P.M.—"Refractories for Highly Corrosive Fluorosilicate Melts" by W. Eitel, R. A. Hatch, and R. A. Humphrey, U. S. Bureau of Mines, Norris, Tenn. (Abstract No. 49)

4:00 P.M.—" 'Durhy'—An Unusual Silicon Carbide Body" by C. G. Rose, Research Department, The Carborundum Company, Niagara Falls, N. Y. (Abstract No. 50)

(This symposium will continue at 9:00 A.M., Friday, April 21st, in the Pine Room.)

Symposium on Luminescence (cont'd) with Dr. H. C. Froelich presiding

(PINE ROOM)

2:00 P.M.—"Barium Magnesium Silicate Phosphors" by Keith H. Butler and James G. Cassanos, Sylvania Electric Products Inc., Salem, Mass. (Abstract No. 69)

2:30 P.M.—"Some Interesting Rare Earth Activated Phosphors" by H. G. Jenkins and A. H. McKeag, Research Laboratories, The General Electric Company, Limited, Wembley, England (Abstract No. 70)

2:50 P.M.—"Calcium Halophosphate Phosphors. I. Analysis of Emission Spectra" by Keith H. Butler and Charles W. Jerome, Sylvania Electric Products Inc., Salem, Mass. (Abstract No. 71)

3:10 P.M.—"Luminescence Emission of Manganese-activated Zinc Silicate at Liquid Helium Temperature" by Clifford C. Klick and James H. Schulman, Crystal Branch, Naval Research Laboratory, Washington, D. C. (Abstract No. 72)

3:30 P.M.—"The Zinc Silicate Phosphors Fluorescing in the Yellow and Red" by H. G. Pfeiffer and Gorton R. Fonda, Research Laboratory, General Electric Company, Schenectady, N. Y. (Abstract No. 73)

3:50 P.M.—Ten minute stretch.

THURSDAY P. M.

4:00 P.M.-5:30 P.M.—The Luminescence group has scheduled a **Round-Table** for this time so that those attending the session may have an opportunity for an informal and more detailed discussion of the papers presented at this meeting.

FRIDAY, APRIL 21, 1950

Symposium on Electrothermics (cont'd)
New Highly Refractory Oxides
with Mr. A. E. Pavlish presiding

(PINE ROOM)

9:00 A.M.—"Production of Fused Stabilized Zirconia" by D. W. Marshall, Norton Company Research Laboratories, Chippawa, Ontario, Canada (Abstract No. 51)

9:30 A.M.—"Stabilized Zirconia Refractories" by O. J. Whittemore, Jr., Norton Company Research Laboratories, Worcester, Mass. (Abstract No. 52)

10:00 A.M.—"Vapor Pressure of Beryllium Oxide" by N. D. Erway, 155 Lincoln Street, Oregon, Wis., and R. L. Seifert, Indiana University, Bloomington, Ind. (Abstract No. 53)

10:30 A.M.—"Sintered Oxides" by Karl Schwartzwalder and Helen B. Barlett, AC Spark Plug Division, General Motors Corporation, Flint, Mich. (Abstract No. 54)

11:00 A.M.—"High Temperature Electrical Insulators" by W. T. Rawles, Chemicals Division, General Electric Company, Pittsfield, Mass. (Abstract No. 55)

11:30 A.M.—"High-Temperature Bodies in the System MgO-TiN-NiO" by L. D. Hower, Jr., H. F. G. Ueltz, and J. W. Londeree, Jr., Rutgers University, New Jersey Ceramic Research Station, New Brunswick, N. J. (Abstract No. 56)

(This symposium will continue at 2:00 P.M., Friday, April 21st, in the Pine Room.)

Symposium on Theoretical Electrochemistry
with Professor William von Fischer presiding

(OHIO ROOM)

9:00 A.M.—"Electrodeposition Behavior of a Simple Ion. II. Precipitation into a Liquid Electrode (mercury)" by L. B. Rogers, Massachusetts Institute of Technology, Cambridge, Mass. (Abstract No. 74)

FRIDAY P. M.

9:30 A.M.—"Electrodeposition Behavior of a Simple Ion. III. Applications of Coprecipitation Phenomena" by L. B. Rogers and John T. Byrne, Massachusetts Institute of Technology, Cambridge, Mass. (Abstract No. 75)

10:00 A.M.—"Anodic and Cathodic Depolarization Effects on Various Metals in Sulfuric Acid Solutions" by A. L. Ferguson, University of Michigan, Ann Arbor, Mich., and D. R. Turner, Westinghouse Research Laboratories, East Pittsburgh, Pa. (Abstract No. 76)

10:30 A.M.—"Anode Effect in Aqueous Electrolysis" by H. H. Kellogg, School of Mines, Columbia University, New York, N. Y. (Abstract No. 77)

11:00 A.M.—"Gold-plated Electrode for Measuring Conductance of Electrolytes" by Sidney Barnartt, Westinghouse Research Laboratories, East Pittsburgh, Pa. (Abstract No. 78)

11:30 A.M.—"On the Determination of the Roughness of Metallic Surfaces" by Carl Wagner, Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass. (Abstract No. 79)

12:00 M.—"Nitric Acid—Nitrous Acid Concentration Cells" by William Cabler Moore, Consulting Chemist, Stamford Conn. (Abstract No. 80)

12:20 P.M.—Annual business meeting and election of officers of the Theoretical Division.

(This symposium will continue at 2:00 P.M., Friday, April 21st, in the Ohio Room.)

Symposium on Electrothermics (cont'd)
Cermets and Metal-Ceramic Systems
with Dr. I. E. Campbell presiding

(PINE ROOM)

2:00 P.M.—"A Survey of High Temperature Metals and Ceramics" by Hans Thurnauer, American Lava Corporation, Chattanooga, Tenn. (Abstract No. 57)

2:30 P.M.—"Metal Ceramics for High Temperature Applications" by W. O. Sweeny, Haynes Stellite Division, Union Carbide and Carbon Corporation, Kokomo, Ind. (Abstract No. 58)

3:00 P.M.—"A Study of High Temperature Oxidation Kinetics in Metal Oxide Mixtures" by V. D. Frechette, W. B. Crandall, H. S. Levine, and G. E. Lorey, New York State College of Ceramics at Alfred University, Alfred, N. Y. (Abstract No. 59)

FRIDAY P. M.

3:30 P.M.—"Hydrostatic Pressing as a Fabrication Technique" by H. E. Wagner and C. G. Harman, Battelle Memorial Institute, Columbus, Ohio (Abstract No. 60)

4:00 P.M.—"Fundamental Concept in Sintering and Properties of Oxide-Metal Cermets" by T. S. Shevlin, Engineering Experiment Station, Ohio State University, Columbus, Ohio (Abstract No. 61)

4:30 P.M.—"Soldering of Ceramics and Nonmetals" by R. J. Bondley, General Electric Company, Schenectady, N. Y. (Abstract No. 62)

(A round-table discussion of papers presented at the Electrothermics sessions will be held Saturday, April 22nd, at 9:00 A.M. in the Pine Room.)

Symposium on Theoretical Electrochemistry (cont'd)
with Professor William von Fischer presiding

(OHIO ROOM)

2:00 P.M.—"The Effect of Acoustical Radiations on the Hydrogen Electrode" by Ernest Yeager and Frank Hovorka, Department of Chemistry, Western Reserve University, Cleveland, Ohio (Abstract No. 81)

2:25 P.M.—"Hydrogen Overvoltage of Titanium and Zirconium" by Carl G. Moore, D. S. McKinney, and J. C. Warner, Department of Chemistry, Carnegie Institute of Technology, Pittsburgh, Pa. (Abstract No. 82)

2:50 P.M.—"On the Theory of Corrosion of Composite Electrodeposited Coatings" by J. E. Stareck, United Chromium Inc., Detroit, Mich. (Abstract No. 83)

Symposium on Electric Insulation
New Techniques in Electrical Insulation Research
with Mr. Thomas D. Callinan presiding

(OHIO ROOM)

3:15 P.M.—"The Breakdown of Electrical Insulation at Radio Frequencies" by John J. Chapman, Johns Hopkins Research Institute, Baltimore, Md. (Abstract No. 84)

4:00 P.M.—"The Infrared Analysis of Polyvinyl Formal" by Harold C. Beachell, University of Delaware, Newark, Del. (Abstract No. 85)

4:45 P.M.—"The Thermal Evaluation of Polyvinyl Formal" by Thomas D. Callinan, Naval

SATURDAY A.M.

Research Laboratory, Washington, D. C.
(Abstract No. 86)

(This symposium will continue at 9:00 A.M., Saturday, April 22nd, in the Ohio Room.)

SATURDAY, APRIL 22, 1950

Symposium on Electric Insulation
Paper-Makers' Contributions to Electrochemical Arts
with Mr. Thomas D. Callinan presiding

(OHIO ROOM)

9:00 A.M.—"The Manufacture of Electrical Insulating Paper" by Phillip L. Staats, General Electric Company, Pittsfield, Mass.
(Abstract No. 87)

10:00 A.M.—"Manufacture and Properties of Asbestos Paper" by Robert G. Quinn, Johns-Manville Research Center, Finderne, N. J.
(Abstract No. 88)

11:00 A.M.—"The Manufacture and Properties of Integrated Mica" by Moses D. Heyman, Integrated Mica Corporation, Woodmere, N. Y.
(Abstract No. 89)

ELECTROTHERMIC ROUND TABLE

(PINE ROOM)

The New Highly Refractory Materials

9:00 A.M.-12:00 M.—An informal "off the record" discussion of papers presented at the Electrothermic sessions will be led by prominent authorities in the field. All those interested are invited to attend and participate in the discussions.

Abstracts of papers to be presented appear on the following pages.

Abstracts

RARE METALS

ABSTRACT NUMBER 1

BENEFICIATION OF HIGH TITANIUM INDIAN BAUXITE THROUGH CHLORINATION

Colin G. Fink and K. G. Hrishikesan
Columbia University, New York, N. Y.

THE great expansion of the aluminum industry during the last three decades has made bauxite an important economic raw material. Bauxite obtained from the mines in France and the Guianas is the ore which is used largely in the production of aluminum. Extensive deposits of bauxite have been discovered in India, but their commercial exploitation had not been undertaken until a few years ago because of the lack of an Indian aluminum industry. Now, with the increase in aluminum production in India, Indian bauxite is receiving greater attention. One important characteristic of the Indian bauxite is its high titanium content, which gives rise to higher costs in the purification process. The aim of our present investigation is to beneficiate the bauxite through chlorination so that most of the titania can be removed without much loss of alumina.

ABSTRACT NUMBER 2

THE FORMATION OF REFRACTORY COATINGS BY VAPOR-DEPOSITION METHODS

II. The Deposition of Group IV Metals

C. F. Powell, C. C. Heim,* and I. E. Campbell
Battelle Memorial Institute
Columbus, Ohio

ADHERENT and nonporous deposits of all of the Group IV metals may be obtained by thermal decomposition or hydrogen reduction of their halides. The physical properties of the coatings are markedly influenced by the presence of nitrogen, carbon, and oxygen, and controlled additions of these elements can be used to regulate the hardness of the coatings.

* Formerly at Battelle, now with Kaiser Aluminum and Chemical Corporation, Spokane, Washington.

ABSTRACT NUMBER 3

HEAT RESISTANCE OF ZIRCONIUM IN SEVERAL MEDIA

E. T. Hayes, A. H. Roberson, and R. H. Robertson
U. S. Bureau of Mines
Albany, Oregon

ZIRCONIUM sheet was heated in carbon monoxide, carbon dioxide, hydrogen, sulphur dioxide, propane, and steam at atmospheric pressure. Weight changes and tensile properties were determined, metallographic structures discussed, and safe heating temperatures for the metal exposed to the various gases deduced.

ABSTRACT NUMBER 4

IMPROVEMENTS IN THE METHODS FOR THE REDUCTION OF ZIRCONIUM CHLORIDE WITH MAGNESIUM

W. J. Kroll, W. F. Hergert, and L. A. Yerkes
U. S. Bureau of Mines
Albany, Oregon

THE results of laboratory investigations on improvements in the present Bureau of Mines process for the reduction of gaseous anhydrous zirconium chloride with magnesium, under helium, are reported. These investigations disclose that iron may be reduced to the ferrous state with hydrogen in the bed of zirconium chloride at temperatures of about 200°C. This results in saving a sublimation and condensation step. It has been shown that a cast iron crucible is a superior material of construction and can replace the presently used mild steel. Finally, it has been shown that mixtures of 80% sodium and 20% magnesium have been successfully used in the final reduction step.

ABSTRACT NUMBER 5

PALLADIUM PLATING BATHS FOR HEAVY DEPOSITS AND ELECTROFORMING

E. M. Wise and R. F. Vines
International Nickel Company, Inc.
New York, New York

THE development of a high efficiency chloride bath for the production of heavy ductile deposits of palladium is described. This bath operates with soluble palladium and is practically self-maintaining as both the anode and cathode efficiencies are very high. The heavy deposits from this bath will withstand annealing without blistering and will be ductile both before and after such annealing treatments. To achieve these results, it is essential that the bath be maintained at a very high state of purity, as minute amounts of the common base metals exercise very deleterious effects on the deposit.

ABSTRACT NUMBER 6

THE ELECTROCHEMISTRY OF GALLIUM

William M. Saltman and Norman H. Nachtrieb
Institute for the Study of Metals
University of Chicago
Chicago, Ill.

ELECTROMOTIVE force measurements were made on cells of the type $Ga_{(s)}/GaCl_3 + HCl/H_2$ (Pt) at 20°, 25°, and 28°C for various concentrations of gallium chloride in 0.005, 0.010, and 0.030 molal hydrochloric acid. The standard electrode potential for the gallium-gallic ion electrode in aqueous solution at 25°C is found to be 0.5604 ± 0.0049 volts. The standard free energy, entropy, and enthalpy for the cell reaction at 25°C are calculated to be $-38{,}800$ cal mole^{-1}, -39.2 cal mole^{-1} deg^{-1}, and $-50{,}500$ cal mole^{-1}, respectively.

ABSTRACT NUMBER 7

EVALUATION OF QUALITY OF GERMANIUM BY ELECTRICAL METHODS

W. C. Dunlap, Jr.
Research Laboratory
General Electric Company
Schenectady, N. Y.

METHODS are outlined for evaluating the quality of germanium without construction of the completed device in which the germanium is to be used. The chief problems are: (*a*) purity, (*b*) homogeneity, (*c*) stability.

The following techniques are discussed: (1) resistivity, (2) hall-effect and magneto-resistance, (3) thermoelectric effects, (4) temperature variation of conduction properties, (5) heat cycling and heat treatment, and (6) stability tests.

ABSTRACT NUMBER 8

SINGLE CRYSTALS OF GERMANIUM AND INVESTIGATION OF SINGLE GRAIN BOUNDARIES

W. E. Taylor, H. Y. Fan, and K. Lark-Horovitz
Department of Physics
Purdue University
Lafayette, Ind.

METHODS for the preparation of purest germanium have been improved by introducing a combination of etching and vacuum remelting. In this way melts have been produced of a resistivity of about 30-40 ohm-cm, corresponding to 1×10^{14} carriers at room temperature, only a fraction smaller than the theoretical minimum number 8×10^{13}. By growing large crystals it is possible to investigate single grain boundaries between N - N regions. Investigations of such boundaries show that their electrical behavior can be well represented by assuming that surface states exist at the grain boundary, and their numbers can be determined from the breakdown and electrical characteristics. Such large grains have also enabled the preparation of samples containing a single boundary between P and N type regions.

ABSTRACT NUMBER 9

COUNTERELECTRODES FOR SELENIUM RECTIFIERS

Wm. B. Roberts
Sylvania Electric Products Inc.
Bayside, L. I., N. Y.

A BRIEF history of the development of the selenium rectifier is given and its various components are treated in general. The counterelectrode is particularly emphasized and its function, application and composition are dealt with in detail. References of particular interest relating to the foregoing are cited.

ABSTRACT NUMBER 10

THE FORMATION OF REFRACTORY COATINGS BY VAPOR-DEPOSITION METHODS

IV. The Deposition of Chromium, Molybdenum, Tungsten, Uranium, Rhenium, and the Platinum Group Metals The Deposition and Formation of Alloy Coatings

D. L. Day, C. C. Heim*, C. F. Powell, and I. E. Campbell
Battelle Memorial Institute
Columbus, Ohio

MOLYBDENUM and tungsten coatings are formed by hydrogen reduction of their chlorides. The platinum group metals are deposited by decomposition of the carbonyl chlorides. Rhenium may be deposited by pyrolysis of its volatile chlorides, and uranium by thermal decomposition of the triiodide stabilized with iodine.

By proper selection of reactions and plating conditions, alloys of most of the refractory metals can be obtained over wide ranges of compositions, thus making it possible to prepare alloys not obtained by conventional methods.

* Formerly at Battelle, now with Kaiser Aluminum and Chemical Corporation, Spokane, Washington.

ABSTRACT NUMBER 11

DUCTILE CHROMIUM

W. J. Kroll, W. F. Hergert, and L. A. Yerkes
U. S. Bureau of Mines
Albany, Oregon

OXIDE-BEARING chromium powder, made either by reduction of chromium trichloride with magnesium under helium, or electrolytic commercial powder, is deoxidized with dry, high-purity hydrogen at elevated temperature. The pure hydrogen needed for this operation is obtained by thermal dissociation of zirconium hydride produced in a continuous stream from a two-furnace arrangement, permitting easy absorption-purification and desorption of the hydride. The chromium metal, after compacting, is malleable at about 650°C, and can be cut and bent at this temperature.

ABSTRACT NUMBER 12

THE PROPERTIES AND USES OF THALLIUM

H. E. Howe and A. A. Smith, Jr.
Research Department
American Smelting & Refining Company
Barber, N. J.

A REVIEW of the occurrence, recovery, chemical and physical properties of thallium and its compounds is presented. The present major use of thallium is in the form of thallium sulfate which is widely used as a rodenticide. Recent interest has been shown in the activating effect of thallium salts on ultraviolet phosphorescence, the use of thallium iodide-thallium bromide crystals for infrared spectroscopy, and also the thallium-mercury eutectic which has a melting point of $-60°C$, the lowest of any known metallic alloy.

ABSTRACT NUMBER 13

A REVIEW OF THE SYSTEM VANADIUM-OXYGEN

N. P. Allen
National Physical Laboratory
Teddington, Middlesex, England

THE experimental work on the reduction of the oxides of vanadium is reviewed in order to reach conclusions on the energy and phase relations in the system. Information concerning the higher oxides is moderately satisfactory, but little is known for certain about the behavior of mixtures containing less oxygen than VO. New experimental data concerning the constitution and energy relations in this region are given.

ABSTRACT NUMBER 14

THE FORMATION OF REFRACTORY COATINGS BY VAPOR-DEPOSITION METHODS

III. The Deposition of Vanadium, Tantalum, and Columbium

L. C. Beale, Jr., C. F. Powell, and I. E. Campbell
Battelle Memorial Institute
Columbus, Ohio

TANTALUM and columbium coatings are readily deposited on both metallic and nonmetallic bases by hydrogen reduction of their pentachlo-

rides at temperatures above 600°C. On refractory bases such as molybdenum, tungsten, and graphite, thermal decomposition of the pentachlorides and pentabromides may be used to produce coatings of these metals. Vanadium deposition is more difficult to carry out, but satisfactory deposits of vanadium have been obtained by decomposing vanadium diiodide at 1000°-1200°C on the surface of the work.

ABSTRACT NUMBER 15

PRODUCTION OF DUCTILE VANADIUM BY CALCIUM REDUCTION OF VANADIUM TRIOXIDE

E. D. Gregory
Research Department
Westinghouse Electric Corporation
Bloomfield, N. J.

CALCULATIONS were made to determine the heat of reaction of calcium with different oxides of vanadium. These calculations indicated better means of controlling the reaction. Ductile rod, wire, and sheet were fabricated from a powder produced by calcium reduction of V_2O_3. Fabrication furnished some information on working and annealing while other studies yielded physical property, purity, and microstructure data.

ABSTRACT NUMBER 16

PREPARATION OF DUCTILE VANADIUM BY CALCIUM REDUCTION

R. K. McKechnie and A. U. Seybolt
General Electric Company
Schenectady, N. Y.

A METHOD is described for preparing ductile vanadium metal of good purity by calcium reduction of the oxide.

ABSTRACT NUMBER 17

A PRELIMINARY STUDY OF THE REACTIONS OF VANADIUM WITH O_2 AND N_2

Earl A. Gulbransen and Kenneth F. Andrew
Westinghouse Research Laboratories
East Pittsburgh, Pa.

A STUDY is made of the reaction of rolled vanadium sheet with oxygen over the temperature range of 400° to 600°C using specimens

weighing 0.1264 g and having a surface area of 1.4 cm^2. The data may be fitted to the parabolic rate law except for the initial period of the reaction. A plot of log K/T vs. $1/T$ gives an energy of activation of 30,700 calories per mole. The oxidation of vanadium may be compared to the corresponding reactions on columbium and tantalum since the oxide is soluble at high temperatures and the extent of reaction is of the same order of magnitude.

The reaction with nitrogen is studied over the temperature range of 650°C to 900°C. The rate of reaction with nitrogen is much less at a given temperature than the corresponding oxidation reaction. The nitrogen reaction is similar to that found for columbium and tantalum in the magnitude of the reaction and in the fact that the nitride film dissolves in the metal as fast as it is formed. The data may be fitted by the parabolic rate law.

ABSTRACT NUMBER 18

EQUILIBRIA IN THE DECOMPOSITION OF BERYLLIUM IODIDE AT ELEVATED TEMPERATURES

Bernard Kopelman and Harry Bender
Sylvania Electric Products Inc.
Bayside, L. I., N. Y.

EQUILIBRIUM in the decomposition of beryllium iodide between the temperatures 636° to 766°C has been studied. Two simultaneous equilibria are postulated, that of the dissociation of dimeric beryllium iodide into its monomer, and that of monomeric beryllium iodide into its elements. The dissociation constants for each of these equilibria are obtained, from which the heats of reaction may be determined. Beryllium iodide is extremely toxic, hygroscopic, and reactive. Techniques are described for its purification, handling, and performing the equilibrium tests. Platinum is used for the equilibrium studies because of the attack of vaporous beryllium iodide on glass or quartz.

ABSTRACT NUMBER 19

KINETICS OF THE REACTIONS OF BERYLLIUM WITH O_2, N_2 AND H_2, AND THE EFFECTS OF OXIDE AND NITRIDE FILMS ON ITS VAPOR PRESSURE

Earl A. Gulbransen and Kenneth F. Andrew
Westinghouse Research Laboratories
East Pittsburgh, Pa.

A SYSTEMATIC study of the reaction of beryllium with oxygen is made over the temperature range of 350° to 950°C. The experimental data may be fitted by the parabolic rate law except for the initial period of the reaction. A plot of log K/T vs. $1/T$ gives an energy of activation of 50,300 calories per mole. A comparison of this rate data with other metals and alloys shows that vacuum treated beryllium has the smallest parabolic reaction rate constant at 900°C of any metal or alloy that we have studied.

The reaction with nitrogen is studied over the temperature range of 600° to 925°C. The data may be fitted by the parabolic rate law. A comparison with the oxygen reaction shows that the rate of reaction is somewhat smaller. A plot of log K/T vs. $1/T$ gives an energy of activation of 75,000 calories per mole.

No reaction is observed with hydrogen over the temperature range of 300° to 882°C.

A study of the vapor pressure of beryllium and the influence of oxide and nitride films is made using the Langmuir method. Excellent agreement is found for the vacuum treated specimens with the recent results of Holden, Speiser, and Johnston. Oxide films exert a strong effect in reducing the vapor pressure, the effect of varying as the square root of the oxide thickness. A film of 99 micrograms per cm² lowers the vapor pressure 100-fold.

INSTRUMENTATION

ABSTRACT NUMBER 20

SELECTION OF TALC FOR INDUSTRIAL USES BY X-RAY DIFFRACTION

G. L. McCreery
The Ohio Brass Company
Barberton, Ohio

TALC and its associated minerals as disclosed by automatic recording of the x-ray diffraction patterns are illustrated by examples of seven commercial talcs. The wide variation in natural mineral deposits is demonstrated. Presence of quartz or asbestos is readily detected and quantitative estimation for determining health hazard is practical. Preparation and recording of a specimen require about one hour.

ABSTRACT NUMBER 21

HIGH TEMPERATURE AND CONTROLLED ATMOSPHERE X-RAY DIFFRACTION TECHNIQUES

J. J. Lander
Bell Telephone Laboratories
Murray Hill, N. J.

HIGH temperature x-ray diffraction studies of solids yield valuable information about the existence and the structure of high temperature phases, temperatures of transition, rates of reaction, crystal growth, etc. Often such studies must be carried out with the material under investigation in a controlled atmosphere, or in a good vacuum. Simple accessories for standard diffraction equipment will be described. X-ray diffraction studies of the phase transitions of the alkaline earth carbonates, of active thermionic and cold cathode surfaces, and other problems will be discussed in relation to the use of the accessories.

ABSTRACT NUMBER 22

THE APPLICABILITY OF ULTRASONICS TO CONTINUOUS GAS ANALYSIS

J. C. Hubbard
The Catholic University of America
Washington, D. C.

THE discussion is based upon the properties of the piezoelectric resonator, well known for its stability and high selectivity. Four types of equipment are considered as applicable to continuous gas analysis. Certain features are suggested which are also especially advantageous for regulation and control in production.

ABSTRACT NUMBER 23

SELECTIVE INFARED GAS ANALYSIS

Wm. G. Fastie
Leeds & Northrup Company
Philadelphia, Pa.

AN HISTORICAL survey of infrared methods of gas analysis will be presented with emphasis on those most widely employed. An optical demonstration of the principles involved in this type of measurement is planned. A number of laboratory applications of infrared gas analysis equipment will be described. Industrial applications in the oil industry and heat treating industry will be discussed.

ABSTRACT NUMBER 24

ULTRAVIOLET METHODS OF CONTINUOUS GAS ANALYSIS

L. G. Glasser
Engineering Research Laboratory
E. I. du Pont de Nemours & Company, Inc.
Wilmington, Del.

ULTRAVIOLET light absorption measurement has been used for some time for the determination of the concentrations of absorbing gases. Instruments have been constructed for spot reading or continuous recording of the concentration of one component of a mixture. Only a few instruments are commercially available for continuous analysis of atmospheric contamination in order to control noxious or explosive vapors, and for analysis and control of chemical process streams. Widespread use of continuous ultraviolet gas analyzers will not come until certain difficult problems are solved. These problems are: (1) The presence of dust, condensables, and corrosive materials in the sample gas and in the ambient air reduces the accuracy and mechanical reliability of the analyzer; (2) The interference due to sample gas components that absorb ultraviolet light in addition to the component whose concentration it is desired to determine introduces inacccuracies; (3) High sensitivity to small light absorptions must be achieved as well as long- and short-time stability of a high degree.

ABSTRACT NUMBER 25

A CATHODE-RAY RECORDING APPARATUS FOR POLARIZATION

A. L. Ferguson and D. R. Turner*
University of Michigan
Ann Arbor, Mich.

A CATHODE-RAY recording oscillograph is described which is capable of recording the potential changes with time in a single trace over a wide range of speeds, from more than several minutes to 0.001 second total record time. Designed for electrochemical polarization studies the d-c amplifiers required only a very small current for operation with a potential sensitivity of less than 1 millivolt. The time axis was obtained with a moving film drum camera synchronized to the recorded event by photocell

activated switches. Provisions were made for an accurate and rapid calibration of potential and time axes on each record.

* Present address: Westinghouse Research Laboratories, East Pittsburgh, Pa.

ABSTRACT NUMBER 26

ELECTRONIC INSTRUMENTATION FOR OVERVOLTAGE MEASUREMENTS

Dimitrios Staicopoulos, Ernest Yeager, and Frank Hovorka

Departments of Chemistry and Physics
Western Reserve University
Cleveland, Ohio

ELECTRONIC instrumentation has been developed for the measurement of overvoltage by the commutator or indirect method. With this apparatus, current may be interrupted for periods ranging in length from 20 microseconds through one-half the repetition rate for repetition rates from 50 sec^{-1} through 3000 sec^{-1}. Potential measurements may be made at any time while current is either off or on during periods as short as 15 microseconds. Typical accuracy of the potential measurements is $\pm$ 5 mv for measurement periods of 20 microseconds duration at a repetition rate of 300 sec^{-1}. The potential measurements involve the use of a gated-bridge null detector in conjunction with an ordinary potentiometer.

ABSTRACT NUMBER 27

APPLICATION OF ELECTROLYTIC CONDUCTIVITY OF GAS ANALYSES

Moyer D. Thomas and James O. Ivie

Department of Agricultural Research
American Smelting and Refining Company
Salt Lake City, Utah

AN AUTOMATIC conductimetric analyzer for continuous analyses of gas mixtures, particularly contaminants in atmospheric air, is described. Although measurements at dilutions of the order of 10^{-6} mole per liter can readily be made, the apparatus is also adaptable to measurement of high gas concentrations. Variant forms of the apparatus make it suitable for use in the determination of sulfur dioxide, carbon dioxide, hydrogen sulfide, fluoride or chloride, organic chlorine compounds, mercaptan, and thiophen. Simultaneous analyses for two or more components are sometimes possible. One adaptation of the apparatus is being used for continuous determination of aerosols such as sulfates, chlorides, and sulfuric acid in current "smog" studies.

ABSTRACT NUMBER 28

INSTRUMENTATION IN A MODERN CHLORINE HANDLING PLANT

J. M. Hildyard
Hooker Electrochemical Company
Niagara Falls, N. Y.

THE control equipment for a modern chlorine handling plant is described and analyzed. The process consists of equipment for collecting, cooling, drying, compressing, and liquefying chlorine gas. Personal supervision of the equipment by the operators has been reduced by the control means employed. Some information is given for the selection and installation of instruments for chlorine plants.

ABSTRACT NUMBER 29

LIQUID CHLORINE LEVEL MEASUREMENT

F. S. McCarthy and G. A. Rice
Chemicals Department
Canadian Industries Limited
Montreal, Canada

A REVIEW is made of the problem of measuring the level of liquid chlorine in storage tanks and the importance of reliable level determination is discussed. The types of instrument industrially available are classified and the arrangement and operation of instruments of each type are described. The advantages and disadvantages in chlorine service of each instrument are discussed. Reference is made to a novel liquid chlorine depth gauge which depends on the difference in absorption of gamma radiation by liquid and gaseous chlorine.

ABSTRACT NUMBER 30

A FLOW COLORIMETER ADAPTED TO CHLORINE ANALYSIS

R. C. Hawes, H. H. Cary,* R. R. Davis, and A. O. Beckman
National Technical Laboratories
South Pasadena, Calif.

THE Beckman Flow Colorimeter was designed for the continuous measurement of gaseous chlorine or chlorine dioxide in plant streams, by spectral absorption in the ultraviolet or blue regions, although the instrument may determine

any material absorbing in the wavelength range from 350 to 950 $m\mu$, by choice of suitable filters and phototubes. Means are provided for minimizing corrosion and thermal drift. A dual beam principle is employed, with tungsten light source, two phototubes, a 10 cm or shorter sample cell, and a novel amplifier giving protection from line voltage changes. The circuit provides meter deflections proportional to the weight/volume concentration over about the first half scale. A partial pressure of 0.7 mm Hg of chlorine can be reliably detected. Terminals are provided for connections to an external meter or a potentiometric type recorder.

* Present address: Applied Physics Corporation, Pasadena, Calif.

ABSTRACT NUMBER 31

DETECTION OF HYDROGEN IN CHLORINE

Russell E. Cushing
Instrument Process Control Division
Pennsylvania Salt Manufacturing Company
Philadelphia, Pa.

IN THE production of chlorine through electrolysis, hydrogen usually contaminates the product to some extent. High concentrations of hydrogen are hazardous and undesirable. Determination of hydrogen is carried out through the use of an analyzer which operates on the thermal conductivity of the gaseous mixture. A complete description is given of several components required by this method of analysis which are not readily available commercially. The procedure for calibrating the assembled equipment is outlined.

ABSTRACT NUMBER 32

THE VOLTAGE BALANCE IN THE MERCURY CELL

Vittorio de Nora
Impianti Elettrochimici
Milan, Italy

THE distribution of voltage drop through a mercury cell has been calculated and directly measured at different current densities in an industrial De Nora cell which is described.

The cell was operated at constant temperature and fed with 305 g/l sodium chloride solution at a rate proportional to current density.

Voltage-current density curves corresponding to loads from 50% to 150% of rated capacity of the cell are reported and discussed.

ABSTRACT NUMBER 33

AUTOMATIC CONTROL APPLIED TO "KARBATE" FALLING FILM HYDROGEN CHLORIDE ABSORBERS

W. M. Gaylord
National Carbon Division
Union Carbide and Carbon Corporation
Niagara Falls, N. Y.

OPERATION of "Karbate" falling film HCl absorbers consisting of a co-current shell and tube cooler-absorber followed by a counter-current scrubber is described as it affects automatic control requirements of feed water-feed gas ratio. In selecting the best type of control, the following methods now in use were evaluated:

1. Proportioning of water to gas volume rate.
2. Maintaining water ratio from gravity of acid produced.
3. Maintaining constant boiling point of acid produced.
4. Maintaining constant weak acid temperature.

Automatic control of the water-gas ratio using the temperature of the weak acid was selected and adopted on standard "Karbate" HCl absorbers to obtain the following advantages: (1) temperature controller can be set so that absorber produces strongest possible acid without venting HCl over a wide range of feed gas and compositions; (2) negligible time lag and good stability; (3) inexpensive, standard temperature controllers can be used if properly sized.

ABSTRACT NUMBER 34

SALT SLURRY CONTROL IN CAUSTIC EVAPORATORS

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Blaw-Knox Company
Buffalo, N. Y.

THIS paper gives an explanation of the operation of a Backflow Triple Effect Electrolytic Caustic Evaporator, explains the method of controlling the flow of salt slurry, and method of backwashing salt precipitated, to give most efficient performance.

ABSTRACT NUMBER 35

CONTROL OF BLEACH MANUFACTURE BY OXIDATION POTENTIAL

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The Dow Chemical Company
Pittsburg, Calif.

THE reaction of chlorine and caustic soda used in the manufacture of sodium hypochlorite bleach liquors is usually controlled by manual titration but may be better controlled by oxidation potential or pH methods. The oxidation potential method is preferred for reasons of simplicity and accuracy. Proper control results in a product of maximum stability, improved bleaching speed, and more efficient use of raw materials. Curves are presented showing the correlation of alkalinity and oxidation potential as measured by platinum-calomel and platinum-silver electrode pairs. Data on the effect of oxidation potential on stability and bleaching speed are also shown. An automatically controlled continuous process for manufacture on this basis is suggested.

ELECTROTHERMICS

ABSTRACT NUMBER 36

THE METALLIC NATURE OF METAL BORIDES

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THE unusual metallic properties of the diborides of Ti, Zr, Cb, and Ta are discussed. Data are presented on electrical conductivity, thermal conductivity, Wiedemann-Franz ratio, and temperature coefficient of resistivity of these borides. The metallic nature of these compounds is clearly indicated by these data.

ABSTRACT NUMBER 37

THE BORIDES OF SOME TRANSITION ELEMENTS

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University of Uppsala
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A COMPREHENSIVE discussion of the structural work on the borides of the transition elements is given, including tables of axial lengths and interatomic distances. The structures are discussed with respect to the arrangement of the boron atoms.

The boron atoms appear isolated, in chains, in double chains, in nets, or in three-dimensional boron frameworks. The crystallographic evidence clearly shows that the boron-boron contacts are of bonding character.

Similarities between borides and hydrides, carbides, and nitrides exist, but Hägg's critical radius ratio is valid only if the boron atoms appear isolated in the metal lattice.

Pauling's theory for the metallic state seems not to be applicable on the borides. For the borides with chains, for instance, according to Pauling, an electron transfer from the metal to the boron chains occurs. The present author thinks, according to the experimental evidence, that an electron transfer in the opposite direction is more probable.

ABSTRACT NUMBER 38

PHASE RELATIONSHIPS IN THE BINARY SYSTEMS OF NITRIDES AND CARBIDES OF ZIRCONIUM, COLUMBIUM, TITANIUM, AND VANADIUM

Pol Duwez and Francis Odell
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California Institute of Technology
Pasadena, Calif.

PREVIOUS investigators have shown that the binary systems involving the monocarbides of zirconium, columbium, tantalum, titanium, and vanadium are of the solid solution type, with the exception of ZrC-VC which are almost completely insoluble in each other. In the present study it is shown that the mononitrides of zirconium, columbium, titanium, and vanadium, which have the same NaCl type crystal structure as the corresponding carbides, are also soluble in each other, with the exception of the pair ZrN-VN. As in the case of the carbides, this exception can be explained on the basis of the atomic size rule governing the formation of solid solution. Furthermore, it is established that most of the binary systems formed by a carbide and a nitride are of the solid solution type, providing the atomic diameters of the metal atoms do not differ by more than about 15%. The systems involving zirconium carbide with the nitrides were not investigated because zirconium carbide decomposed in a nitrogen atmosphere at high temperature.

ABSTRACT NUMBER 39

ELECTROTHERMAL PREPARATION OF PURE CRYSTALLINE BORON, BORON NITRIDE, AND BORON CARBIDE, AND THEIR CHARACTERISTICS

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Dayton Ohio

ELECTROTHERMAL methods to prepare such high-refractory substances as pure crystalline elementary boron, pure boron nitride, and pure transparent boron carbide are described. Characteristics concerning hardness, microstructure, and optical properties of the substances are briefly given. Ten color photomicrographs, taken in polarized incident and transmitted light, illustrate the prepared specimens.

ABSTRACT NUMBER 40

THE FORMATION OF REFRACTORY COATINGS BY VAPOR-DEPOSITION METHODS

VI. The Refractory Nitrides, Borides, Silicides, and Oxides

C. F. Powell, D. H. Nowicki, and I. E. Campbell
Battelle Memorial Institute
Columbus, Ohio

COATINGS of the refractory nitrides, borides, and silicides can be obtained by the reaction of metal chlorides with N_2-H_2, BCl_3-H_2, and $SiCl_4$-H_2 atmospheres, at a heated surface under carefully controlled conditions. Where difficulty is encountered in controlling the relative rates of deposition of metal and nonmetal, the metal may be deposited first and then nitrided, borided, or siliconized. Oxide coatings may be obtained by the decomposition of, or the reaction of, metal halides with an H_2CO_2 atmosphere.

ABSTRACT NUMBER 41

SOME ASPECTS OF THE USE OF SOLAR ENERGY FOR STUDYING HIGHLY REFRACTORY COMPOUNDS AND MATERIALS

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Kansas City, Mo.

THIS paper is a survey of the history of the use of solar energy for obtaining high temperatures. Covered are principles involved in the construction of the Rockhurst solar furnaces with parabolic mirrors up to 120 in. in diameter. Examples are given of studies at very high temperatures which show that solar energy can be used for investigating highly refractory compounds and materials under very pure conditions in an oxidizing atmosphere and at atmospheric pressure. The rate of heating may be varied from several hours to a few seconds for reaching several thousand degrees. The rotation of the earth can better be compensated for by mounting the reflector and accessories on a polar axis than by trying to keep the sample in the focal area by visual or photoelectric guidance.

ABSTRACT NUMBER 42

REFRACTORIES FOR FOUR THOUSAND DEGREES PLUS

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THE known materials which melt above 4000°F are reviewed and their properties discussed. They are characterized by strong chemical bonds, great hardness, unusual mechanical properties, and resistance to chemical corrosion. Calculations of atomic volumes are shown to illustrate the dense packing observed in carbides and borides. Methods of production and of fabrication are described. Carbides, borides, nitrides, and oxides can be "hot-pressed" in simple shapes to nearly maximum density.

ABSTRACT NUMBER 43

THE PROTECTION OF MOLYBDENUM FROM OXIDATION IN AIR AT HIGH TEMPERATURES

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Battelle Memorial Institute
Columbus, Ohio

MOLYBDENUM can be rendered highly corrosion resistant by treatment with a hydrogen-silicon tetrachloride atmosphere at 1000° to 1800°C so as to produce a molybdenum disilicide coating at its surface. One-mil coatings thus produced have completely protected the base

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metal for over 4000 hours in air at 1000°C, and for over 30 hours at 1700°C. Thicker coatings, within limits, give proportionately longer lives. Although brittle at room temperatures, the coatings have limited ductility at a red heat, and the coating tends to be self-healing.

ABSTRACT NUMBER 44

HEAT RESISTANT PROTECTIVE COATINGS

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THIS paper presents the results of research leading to the development of heat resistant protective coatings. Three coatings are reported that will withstand temperatures above 800°F for extended periods of time. The coatings have excellent adhesive and corrosion resistant properties.

One-coat and two-coat systems are discussed. The primer coat of the two-coat system consists of a pigmented heat reactive phenolic vehicle. The coating used in the top coat of the two-coat system, and in the single-coat system, consists of a pigmented silicone or silicone-alkyd resin combination. Pigments reported are aluminum, cadmium, certain ceramic oxides, and leached ilmenite (iron oxide-titanium dioxide). One coating developed is for use on low carbon (SAE 1020) steel. The other coatings are for stainless steel application. Methods used for coating formulation and testing are fully discussed.

ABSTRACT NUMBER 45

REFINING OF MAGNESIUM BY VAPORIZATION AT EXTREMELY LOW PRESSURE

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Ottawa, Canada

THE experiments described indicate that magnesium alloy scrap may be refined by vaporization of the magnesium at gauge pressures less than 0.05 micron. The refined metal contains no manganese and only small traces of aluminum, silicon, copper, and iron. The zinc is vaporized and condensed. However, the zinc content of the refined magnesium is substantially lower than that of the original charge. Considerable operating data and a detailed description of the experimental equipment are included.

ABSTRACT NUMBER 46

EFFECT OF CHROMIUM ON THE OXIDATION RESISTANCE OF TITANIUM CARBIDE

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National Lead Company
Niagara Falls, N. Y.

IT HAS been found that a small percentage of chromium in recrystallized titanium carbide improves the resistance of this material to oxidation at elevated temperatures. The amount of oxidation was determined by the increase in weight of the specimens of different chromium contents after heating in air at 650°C, 850°C, 1200°C, and 1400°C. The data obtained from these tests show that the maximum oxidation resistance, at each temperature, is obtained with an addition of 5% chromium.

ABSTRACT NUMBER 47

THE FORMATION OF REFRACTORY COATINGS BY THE VAPOR-DEPOSITION METHOD

V. The Refractory Carbides

C. F. Powell and I. E. Campbell
Battelle Memorial Institute
Columbus, Ohio

COATINGS of the refractory carbides are obtained on metallic or nonmetallic bases by reduction of metal chlorides in a hydrogen-hydrocarbon atmosphere under carefully controlled conditions, or by deposition of the metal followed by carburization of the plate. When a metal is to be coated with its own carbide, heat treatment in a hydrocarbon-containing atmosphere is frequently satisfactory.

ABSTRACT NUMBER 48

PREPARATION OF ALUMINA-TITANIUM CARBIDE BODIES BY HOT PRESSING

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and Walter J. Koshuba
NEPA Division
Fairchild Engine and Airplane Corporation
Oak Ridge, Tenn.

IN THE formation of massive, refractory materials, reference is made to several techniques including: casting of melt, sintering, and hot pressing. Mixtures of 70% alumina-30% titanium carbide powders have been fabricated by hot press methods. Tublar specimens capable of being heated by their own resistance were developed. The hot press and accessory induction heating equipment is described. Preliminary electrical and physical property measurements are tabulated. Representative photographs show the microstructure of the alumina-titanium carbide combination.

ABSTRACT NUMBER 49

REFRACTORIES FOR HIGHLY CORROSIVE FLUOROSILICATE MELTS

W. Eitel, R. A. Hatch, and R. A. Humphrey
Norris, Tenn.

MICA and amphibole-asbestos syntheses from extremely corrosive fluorosilicate melts require especially resistant refractories. Tests on representative refractory types showed that the platinum group, graphite, and special SiC bodies most nearly fulfill the requirements. Oxide refractories have moderate corrosion resistance and induce excessive nucleation, detrimental to large crystal growth. SiC crucibles bonded with ball-clay and beryl have been used successfully for the fusion and crystallization of 70-pound mica batches.

ABSTRACT NUMBER 50

"DURHY"—AN UNUSUAL SILICON CARBIDE BODY

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The Carborundum Company
Niagara Falls, N. Y.

THE manufacture by electrothermic methods of a dense body comprised of silicon carbide impregnated with silicon is described. Properties of this material are disclosed by physical, electrical, and thermal tests. Possible uses are discussed, based on the unusual combination of refractoriness, electrical conductivity, abrasion resistance, and inertness to many reagents; several examples are given showing applications which take advantage of these characteristics. Present limitations imposed by manufacturing techniques are outlined.

ABSTRACT NUMBER 51

PRODUCTION OF FUSED STABILIZED ZIRCONIA

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THE production of fused stabilized zirconia is described. This high temperature refractory is made by fusing a mixture of zirconia ore, coke, iron borings, and lime in a water cooled electric furnace. A dense fused stabilized zirconia of very high quality is produced.

ABSTRACT NUMBER 52

STABILIZED ZIRCONIA REFRACTORIES

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THE preparation, properties, and uses of refractories made from electrically fused stabilized zirconia are described. These refractories have a very high fusion point (approximately 2600°-2650°C), unusually low thermal conductivity (about one-third that of fused alumina and magnesia refractories), relatively good thermal shock resistance, and are resistant to oxidizing and moderately reducing atmospheres. Because of low electrical resistivity at high temperatures, stabilized zirconia tubes have been used as electrical resistors to as high as 2400°C.

ABSTRACT NUMBER 53

VAPOR PRESSURE OF BERYLLIUM OXIDE

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Chicago, Ill.

THE vapor pressure of beryllium oxide has been measured by a modification of the Knudsen effusion method, utilizing radioactive $_4Be^7$ as tracer. In the experimental temperature range of 1950°C to 2150°C the vapor pressure is given by the equation

$$\log_{10} p_{mm} = 18.50 - \frac{34{,}230}{T} - 2 \log_{10} T$$

The boiling point of liquid beryllium oxide is

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estimated to be 4120 ± 170°C with a molar entropy of vaporization at the boiling point of 25.6 ± 2.7 cal/deg.

ABSTRACT NUMBER 54

SINTERED OXIDES

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General Motors Corporation
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TECHNIQUES are described for fabricating impervious ceramic ware from refractory, nonplastic materials, especially aluminum oxide; oxides of beryllium, magnesium, thorium, and zirconium are also discussed. The influence on the microstructure of the method of forming the shape, the type of raw materials, and the firing conditions are described and illustrated in photomicrographs. Physical properties are given.

ABSTRACT NUMBER 55

HIGH TEMPERATURE ELECTRICAL INSULATORS

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THE requirements of high temperature electrical insulators and the important physical and electrical properties of periclase, quartz, and corundum are presented. Periclase has the highest specific resistance above 1090°C, the highest thermal conductivity and the best physical properties for many applications, particularly in the case of sheathed heating units.

ABSTRACT NUMBER 56

HIGH TEMPERATURE BODIES IN THE SYSTEM MgO-TiN-NiO

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New Jersey Ceramic Research Station
New Brunswick, N. J.

THIS investigation was undertaken in a search for a high temperature product having chemical and physical properties not available in ceramic materials or metals alone. Metalloid-metal bonded oxide bodies of the MgO-TiN-NiO system were produced in which the different components

are united by a chemical bond rather than a physical bond. Titanium nitride was introduced to serve as a bonding medium through solution or by wetting. Sintering was performed in an inert atmosphere.

MgO is partially reduced by TiN with the resultant formation of TiO which is believed to be mutually soluble with MgO in the solid state. NiO is reduced to nickel metal in firing. Data are presented on thermal shock tests and transverse strength at room and elevated temperatures.

ABSTRACT NUMBER 57

A SURVEY OF HIGH TEMPERATURE METALS AND CERAMICS

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NEW industrial developments, such as electrical resistance heating to high temperatures, jet and turbo jet propulsion, or atomic power, require materials withstanding high temperatures under severe operating conditions. Physical properties of suitable metals and ceramics are described. Metals and alloys are classified according to their ability to withstand oxidation. Refractory ceramics are either pure oxide or carbide types. Some are distinguished by high electrical insulation resistance at elevated temperatures, whereas others show sufficient electrical conductivity to be useful as electrical resistors in high temperature furnaces. The uses and limitations of these materials are discused.

ABSTRACT NUMBER 58

METAL CERAMICS FOR HIGH TEMPERATURE APPLICATIONS

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Union Carbide and Carbon Corporation
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DATA are presented on the physical and mechanical properties of metal ceramics as well as information on current limitations on sizes and shapes that can be produced. Various methods for joining metal ceramics to themselves with other materials are outlined and details on machining and grinding this new type material are discussed. The high temperature applications in which Metamic has been tested are reviewed with the object of evaluating the probable field for this type of product .

ABSTRACT NUMBER 59

A STUDY OF HIGH TEMPERATURE OXIDATION KINETICS IN METAL-OXIDE MIXTURES

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at Alfred University
Alfred, N. Y.

BINARY mixtures of cobalt, nickel, and iron with alumina and beryllia were studied in powder compacts by continuous weighing and by oxide layer growth measurement. The principal factors affecting oxidation rate are discussed and a mechanism of oxidation progress is suggested.

ABSTRACT NUMBER 60

HYDROSTATIC PRESSING AS A FABRICATION TECHNIQUE

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Columbus, Ohio

THE design, fabrication, and operation of hydrostatic pressing equipment are discused. Details are given for the fabrication of cylindrical specimens in special pressing fixtures. Methods for shaping irregular specimens without expensive dies are outlined. Processing of materials to be pressed is discussed as to particle size and particle size distribution. The elimination of binder in the powder is possible in some cases if hydrostatic pressing is used. The advantage of the uniform pressing of this method is revealed by the elimination of laminations in the sintered body.

ABSTRACT NUMBER 61

FUNDAMENTAL CONCEPT IN SINTERING AND PROPERTIES OF OXIDE-METAL CERMETS

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RELATIVE to the problem of providing materials which will allow increased operating temperatures in jet propelled devices, a theory of wetting and bonding which has been successfully applied to cermets composed of chromium

and alumina is briefly reviewed and three methods for applying it to cermet solid bodies are given. The general properties of cermets are discussed in the light of those possessed by the ceramic oxide and the metal components.

ABSTRACT NUMBER 62

SOLDERING OF CERAMICS AND NONMETALS

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CERAMIC and nonmetallic materials bonded to metals are finding many uses in bushings for pressurized vessels and vacuum tube envelopes. By proper selection of components, the seals can be designed for particular properties, such as low electrical loss, high mechanical strength, or resistance to thermal shock.

LUMINESCENCE

ABSTRACT NUMBER 63

EFFECT OF THERMAL HISTORY ON COLOR OF ZINC BERYLLIUM SILICATE (Mn) PHOSPHORS

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THE fluorescent colors at room temperature of zinc beryllium silicate phosphors can be changed toward the green by reheating them to temperatures lower than the original firing temperature and subsequently cooling them either at a normal rate or very quickly as by quenching in water. The color changes are ascribed to migrations of both manganese and beryllium in the crystal lattice.

ABSTRACT NUMBER 64

CALCIUM ANTIMONATES

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Salem, Mass., and Bayside, L. I., N. Y.

THREE compounds containing calcium and antimony have been prepared, namely calcium metaantimonate, calcium pyroantimonate, and calcium fluoantimonate. X-ray powder diffraction patterns have been obtained and analyses made. The data are compared with previous work and some discrepancies in the literature are clarified. The bearing on halophosphate phosphors is briefly discussed.

ABSTRACT NUMBER 65

SPIRALING IN FLUORESCENT LAMPS

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FACTORS which produce or affect spiraling in low pressure discharges are discussed and studied in tubes of normal fluorescent lamp and of special design. The order of magnitude of the forces in a discharge is calculated from magnetic deflection measurements. Tension forces in one constricted but not spiraling type of discharge were found to be about 10 to 30 dynes. Spectroscopic study of the constricted and magnetically distorted plasma revealed the presence of barium, strontium, and probably calcium. Langmuir, *et al.*'s theory of the constricting sheath has been applied with the modification that in fluorescent lamps the sheath is believed to be caused by sputtered alkaline earth vapors or aggregates instead of tungsten vapors or aggregates, and the role of carbon aggregates is still uncertain.

ABSTRACT NUMBER 66

A STUDY OF THE MECHANISM OF SENSITIZED LUMINESCENCE OF SOLIDS

James H. Schulman, Robert J. Ginther, and Clifford C. Klick
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Washington, D. C.

REFLECTION, excitation, and emission spectra of $CaSiO_3$: (Pb) and $CaSiO_3$: (Pb + Mn) are reported, as well as measurements of the dependence of luminescence intensity on exciting intensity for $CaSiO_3$: (Pb + Mn) and NaCl: (Pb + Mn). It is shown that the data support the conventional concept of sensitization, where all the ultraviolet absorption is due to the sensitizer; and that Butler's picture, where the activator absorbs ultraviolet, is invalid. An interpretation of the data on the $CaSiO_3$: (Pb + Mn) system is pro-

posed, and the distance over which Pb^{+2} and Mn^{+2} interact in this phosphor is calculated on the basis of this interpretation.

ABSTRACT NUMBER 67

THE ORIGIN OF MULTIPLE BANDS IN LUMINOPHORS ACTIVATED BY DIVALENT MANGANESE

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Eindhoven, Netherlands

AN EXAMINATION of the theories proposed to explain the appearance of multiple bands with manganese activated luminophors indicates that the "cluster" theory is to be preferred to the coordination theory. It is probable that the fluorescent bands are due to transitions from various excited states to one single ground state. The variation of fluorescence with temperature is discussed on the basis of this model and the assumption that several bands originate in one center.

ABSTRACT NUMBER 68

THE FLUORESCENCE OF MAGNESIUM GERMANATE ACTIVATED BY MANGANESE

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Eindhoven, Netherlands

MAGNESIUM germanate activated by manganese may contain the activator in different valencies. When this valency is higher than two, fluorescence excited by ultraviolet occurs in seven narrow bands decaying with the same time constant. The variation of this decay constant and the intensity of fluorescence with temperature is explained by the assumption that the relative contribution of radiative and nonradiative transitions is determined by a Boltzmann equilibrium regulating the population of various excited states.

ABSTRACT NUMBER 69

BARIUM MAGNESIUM SILICATE PHOSPHORS

Keith H. Butler and James G. Cassanos
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Salem, Mass.

THE complex four component system, containing barium oxide, magnesium oxide, lead oxide, and silicon dioxide, has been explored and several new phosphors discovered which emit blue-white or blue-green light when excited by 2537 Å radiation. One of two definite crystal structures are found in the best phosphors. The first of these is a modified barium mesotrisilicate which emits light much like magnesium tungstate. The second is a complex silicate of variable composition and this fluoresces blue-green. Both compounds were previously found in barium lead silicate phosphors, and the introduction of magnesium mainly improves the efficiency of the fluorescence.

ABSTRACT NUMBER 70

SOME INTERESTING RARE EARTH ACTIVATED PHOSPHORS

H. G. Jenkins and A. H. McKeag
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The General Electric Company, Limited
Wembley, England

TWO classes of rare earth activated phosphors are described having interesting and unusual properties. The first series, consisting of alkaline earth silicates activated by divalent europium, shows a wide range of fluorescent colors when excited by 3650 Å radiation. Some of these compounds are characterized by the stability of their fluorescence at comparatively high temperatures.

The second class of phosphors, consisting of alkaline earth pyrophosphates activated by dysprosium and samarium, has unusual phosphorescent characteristics when excited by cathode rays.

ABSTRACT NUMBER 71

CALCIUM HALOPHOSPHATE PHOSPHORS

I. Analysis of Emission Spectra

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THE energy distribution of the emission spectra of a number of calcium halophosphate phosphors has been determined on a recording spectroradiometer. These emission curves have been broken down into component bands, each of which has a Gaussian distribution of energy against wave number. An attempt is made to assign the emission bands to specific energy lev-

els of the excited ions and to interpret their changes in terms of crystal structure and location of the activator atoms.

ABSTRACT NUMBER 72

LUMINESCENCE EMISSION OF MANGANESE-ACTIVATED ZINC SILICATE AT LIQUID HELIUM TEMPERATURE

Clifford C. Klick and James H. Schulman
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Washington, D. C.

FAILURE of the luminescent decay of manganese-activated zinc silicate to follow an exact exponential curve has been cited as evidence for the presence of two different emitting centers with different decay rates. However, spectral emission curves taken at different times after excitation are identical showing that if two centers exist their emissions are the same. The luminescent emission of this phosphor has also been measured at 4°K and shows a single peak several hundred angstroms wide. There is little observed change in the emission between 90°K and 4°K. Room temperature is, therefore, a combination of a broad temperature independent emission band and the temperature broadening of this band. No experimental evidence is found for bands predicted on the assumption that emission spectra are formed by the superposition of bands having the shape of Gauss error curves. Theoretical work on the shape of emission and absorption bands is reviewed and does not support the Gauss error curve theory.

ABSTRACT NUMBER 73

THE ZINC SILICATE PHOSPHORS FLUORESCING IN THE YELLOW AND RED

H. G. Pfeiffer and Gorton R. Fonda
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THE structure of the zinc silicate phosphors which fluoresce in the red and in the yellow has been invesigated afresh. Results on the red-fluorescing form strengthen the conclusion that it is in the amorphous condition. Measurements on the yellow-fluorescing form are in rather close accord with those reported by Rooksby and McKeag. Analysis of its pattern, however, leads to a different conclusion from theirs, namely, that its structure is a distorted form of zinc orthosilicate.

THEORETICAL ELECTROCHEMISTRY

ABSTRACT NUMBER 74

ELECTRODEPOSITION BEHAVIOR OF A SIMPLE ION

II. Precipitation Into a Liquid Electrode (Mercury)

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Cambridge, Mass.

THE distribution of a trace of an element between an aqueous solution of its salt and mercury cathode may be considered as a special example of solvent extraction in which the distribution coefficient is a function not only of the volume of the liquids but also of the cathode potential. If the deposition behavior differs from that predicted from polarographic studies, the deviations provide fundamental information about the reaction.

ABSTRACT NUMBER 75

ELECTRODEPOSITION BEHAVIOR OF A SIMPLE ION

III. Applications of Coprecipitation Phenomena

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COPRECIPITATION, an important consideration in the electro-winning of metals, offers a promising means for recovering traces of radioactive isotopes, particularly those of elements which may be deposited as oxides. The optimum conditions for carrying out a particular deposition should be predictable from relatively few orientation experiments. Applications of the technique using radioactive tracers should provide information of importance to certain phases of alloy plating.

ABSTRACT NUMBER 76

ANODIC AND CATHODIC DEPOLARIZATION EFFECTS ON VARIOUS METALS IN SULFURIC ACID SOLUTIONS

A. L. Ferguson and D. R. Turner*
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ELECTRODES of platinized Pt, bright Pt, Cu, Pb, Ni, and Ag were polarized cathodically for a time and then made anode. Depolarization effects in the resulting anodic curves were interpreted as being the oxidation of cathodic products and intermediate anodic reactions which in some cases included compound formation. Similarly the cathodic depolarization effects of an electrode previously anode were studied. Experiments with bright Pt, Cu, Pb, and Ni were primarily exploratory whereas more detailed studies were made of platinized platinum and especialy Ag electrodes. Suggested electrode reactions producing observed depolarization effects are given with supporting evidence in most cases.

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ABSTRACT NUMBER 77

ANODE EFFECT IN AQUEOUS ELECTROLYSIS

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A PHENOMENON which closely resembles "anode effect" in molten electrolysis was developed in the electrolysis of aqueous solutions at high current density. During "aqueous anode effect" the surface temperature of the anode rises far above the boiling point of the electrolyte, and the gaseous envelope surrounding the anode is maintained by the vaporization of the electrolyte against the hot anode surface. The relation to anode effect in molten media is discussed.

ABSTRACT NUMBER 78

GOLD-PLATED ELECTRODE FOR MEASURING CONDUCTANCE OF ELECTROLYTES

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ELECTRODES for conductance measurements by the Kohlrausch method were prepared by electrodepositing finely divided gold over a layer of smooth gold. Their behavior was studied over the frequency range 1 to 10 kilocycles/sec. In a cell of very low cell constant, no polarization errors were observed at or above 6 kilocycles/sec.

ABSTRACT NUMBER 79

ON THE DETERMINATION OF THE ROUGHNESS OF METALLIC SURFACES

Carl Wagner
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Massachusetts Institute of Technology
Cambridge, Mass.

IT IS shown that the polarization capacity of an electrode can be measured readily with the aid of a ballistic galvanometer. The polarization capacity per unit apparent area can be considered to be approximately proportional to the roughness of the surface of the electrode. Results obtained on silver electrodes illustrate the influence of pretreatment and aging.

ABSTRACT NUMBER 80

NITRIC ACID—NITROUS ACID CONCENTRATION CELLS

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THE differential rate of formation of nitrous acid in two half-cells containing dilute nitric acid, through which nitric oxide is bubbled in series, can be followed by measuring the change with time of the potential, between platinum electrodes immersed in the two solutions. Ideally, the potential drops to zero when the rate becomes identical in the two samples.

ABSTRACT NUMBER 81

THE EFFECT OF ACOUSTICAL RADIATIONS ON THE HYDROGEN ELECTRODE

Ernest Yeager and Frank Hovorka
Department of Chemistry
Western Reserve University
Cleveland, Ohio

MATHEMATICAL consideration is given to the production of alternating components in the electrode potential of a reversible hydrogen electrode in an acoustical field. This effect is discussed in terms of (*a*) a low-frequency region in which the instantaneous conditions are characterized as reversible and (*b*) a higher-frequency region in which relaxation phenomena result because of the lack of instantaneous reversible

conditions. While the former case requires only thermodynamics, the latter involves a kinetic treatment. The reaction constants for the electrode processes at the "reversible" hydrogen electrode can be related to the phase angle and amplitude of the high-frequency effect. Thus the high-frequency effect may provide an interesting test for theories of rate processes at gaseous electrodes.

ABSTRACT NUMBER 82

HYDROGEN OVERVOLTAGE OF TITANIUM AND ZIRCONIUM

Carl G. Moore, D. S. McKinney, and J. C. Warner
Department of Chemistry
Carnegie Institute of Technology
Pittsburgh, Pa.

THE hydrogen overvoltage of titanium and zirconium have been determined by the direct method at various current densities in sulfuric acid of various concentrations. An experimental method has been devised to transfer the specimens into the acid solution without formation of surface oxide.

The effect of the oxide film and of concentration polarization on the hydrogen overvoltage has been investigated. The overvoltages of titanium and zirconium have been found to approximate the values to be expected from their positions in the periodic table.

ABSTRACT NUMBER 83

ON THE THEORY OF CORROSION OF COMPOSITE ELECTRODEPOSITED COATINGS

J. E. Stareck
United Chromium Inc.
Detroit, Mich.

AN ELECTROCHEMICAL theory is developed which explains all known types of corrosion failure of electrodeposited coatings. Experimental results are given to support the theory. Unusual cases are illustrated and explained, such as (*a*), the possible cathodic protection of a basis metal by two separate metal coatings, each of which is more noble than the base, and (*b*), the converse case of accelerated anodic failure of a basis metal by two applied metal coatings each of which is less noble than the base. The basic rules which govern such reactions are formulated and illustrated by test results.

ELECTRIC INSULATION

ABSTRACT NUMBER 84

THE BREAKDOWN OF ELECTRICAL INSULATION AT RADIO FREQUENCIES

John J. Chapman
Johns Hopkins Research Institute
Baltimore, Md.

A SURVEY of the dielectric breakdown of thermoplastic resins, laminated and molded thermosetting resins, and ceramic materials, at frequencies from 60 cycles to 18 megacycles, indicated that levels of breakdown strength existed over distinctive ranges of frequency. It appears that each transition step is associated with a change in the mode of vibration of the charged systems within the dielectric.

ABSTRACT NUMBER 85

THE INFRARED ANALYSIS OF POLYVINYL FORMAL

Harold C. Beachell
University of Delaware
Newark, Del.

A DISCUSSION of the products which form when a typical electrical insulating varnish is thermally aged is presented, and the relation which the deterioration may have to the ultimate life of the dielectric is given. Certain syntheses which have been undertaken and the collaborating results obtained are included.

ABSTRACT NUMBER 86

THE THERMAL EVALUATION OF POLYVINYL FORMAL

Thomas D. Callinan
Naval Research Laboratory
Washington, D. C.

THE electrical and mechanical properties of polyvinyl formal have been determined, and the changes which occur on aging related to the ultimate life of the insulation.

ABSTRACT NUMBER 87

THE MANUFACTURE OF ELECTRICAL INSULATING PAPER

Phillip L. Staats
General Electric Company
Pittsfield, Mass.

THIS paper discusses the various kinds of pulp and the uses of each, the effect of the stock, and the effect of the various means of refining on the ultimate product. The methods and purposes of removing foreign materials from pulps will be presented. The two basic machine types and the advantages and disadvantages of each will receive adequate consideration. The influence of the foregoing on the electrical properties of dielectrics will be mentioned.

ABSTRACT NUMBER 88

MANUFACTURE AND PROPERTIES OF ASBESTOS PAPER

Robert G. Quinn
Johns-Manville Research Center
Finderne, N. J.

THE processing of asbestos fiber and its formation into paper is described. The composition and properties of grades useful in electrical applications are discussed.

ABSTRACT NUMBER 89

THE MANUFACTURE AND PROPERTIES OF INTEGRATED MICA

Moses D. Heyman
Integrated Mica Corporation
Woodmere, N. Y.

IT HAS been found possible to retain the cohesive force of laminae of scrap mica so that they can be caused to recohere to form a solid mass or sheet without the aid of a binder. As a result of this, sheets of pure mica, one hundred feet in length and over, can be fabricated without the aid of a binder.

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FALL MEETING

at the

STATLER HOTEL

Buffalo, New York

October 11, 12, 13, and 14, 1950

SESSIONS ON

Batteries

Corrosion

Electrodeposition

Organic Electrochemistry

Abstracts for the Fall Meeting are due at the Secretary's Office, 235 West 102nd Street, New York 25, N. Y. not later than August 1, 1950

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